# SOME DISEASES OF TREES IN GREATER NEW YORK

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(WITH PLATE 10, CONTAINING 4 FIGURES)

In the course of field work carried on by the writer in Greater New York and the adjacent parts of New Jersey in the summer of 1918, several diseases of forest trees were incidentally studied: those selected for the present paper are important on account of their destructiveness, or interesting by reason of their rarity, or demand attention because they are little understood and need further investigation. A few notes on injury from the extremely disastrous winter of 1917–1918 are added.

The writer wishes to acknowledge his indebtedness to the many persons, some of them named in the text of this paper, who have contributed information or assistance toward its preparation; and to the botanical staff of Yale University for generously placing the Osborn Botanical Laboratory at his disposal for the culture and microscopic work involved.

The diseases are arranged according to host species, the sequence of hosts following that of Sudworth's Check List of the Forest Trees of the United States.[1]

## I. BARK DISEASE OF THE BUTTERNUT (*Juglans cinerea* L.)

Almost without exception the mature butternut trees in the region surveyed were in a moribund condition, sometimes only a few of the smaller branches being dead, while in extreme cases the entire tree had succumbed. Usually the disease appeared to commence on the branches, both those at the top of the tree as well as at the sides of the trunk being affected. During the death of the distal portion of a branch another would develop further

[1] Sudworth, George B. Check list of the forest trees of the United States. U. S. Dept. Agr., Forest Service Bul. 17: 1–144. 1898.

down as a side shoot: this would be eventually killed in its turn, another would arise further down, etc. Thus, while the distal portion of the branch was dead and often entirely devoid of bark, living shoots could be found below. Eventually the whole branch would die and others, sometimes appearing at the branch axil at the trunk would be killed in their turn. It seemed as if the disease entered the trunk in this way, via the dead branches, the death of those at the top of the tree causing a stagheaded aspect characteristic of the disease. Only in a few cases was a prominent crown of suckers observed on the trunk such as occurs in the chestnut bark disease. However, the large number of new branches, mainly orthotropous, which had arisen in the manner described, marked the affected trees in a distinctive manner. Eventually, the death of the whole tree ensued.

That the progress of the disease was slow was indicated, among other things, by the fact that no sudden wilting of the leaves occurred on the affected parts. Moreover, the writer has observed trees in the neighborhood of New Haven, Conn., afflicted with this trouble, or something very similar, for a number of years, and they are not yet entirely dead. It is significant that butternut fruits have been scarce about New Haven for many years.

Dr. G. P. Clinton says that he has noticed the trouble for a number of years, and while he has not investigated it carefully, has had the general impression that the cause is to be looked for in a general decline in the vigor of the host species, just as he believes is the case with the American chestnut and with *Hicoria*. Mr. J. J. Levison, formerly N. Y. City forester, and now consulting forester at Sea Cliff, L. I., states that he has also noticed the disease for some years. Last summer the writer saw affected trees in Pennsylvania and Maryland, and this winter at West Hartford, Conn. Apparently the disease is widespread.

There was no evidence of insect injury about the trees, but wherever it was possible to examine closely one of the diseased limbs the fungus *Melanconium oblongum* Berk. was conspicuous on the dead bark, and often in the immediate vicinity of the healthy tissue. The diseased inner bark was much blackened and formed a strong contrast to the light colored healthy inner bark, the line of demarcation between the two being very clearly defined.

*Melanconium oblongum* Berk. has been collected many times in the U. S., but almost entirely, so far as the writer can ascertain, on *Juglans cinerea.*[2] Berkeley first described it from specimens from the United States in 1873–4.[3] From an examination of published descriptions of *Melanconium* species and from a study of exsiccati we suspect that the organism has several aliases, but until the criminal evidence is more conclusive it is not worth while to discuss them here. Dr. Shear collected the fungus in 1893 in close association with *Diaporthe juglandis* E. & E., and according to a note by him in the herbarium of the N. Y. Botanical Garden, he believed the latter species might be the perfect form of *Melanconium oblongum.*

The spores of the fungus are brown, elliptical-oblong, with homogenous granular contents, or often containing one or more drops or vacuoles, and measure about 20 $\mu$ in length.

It is possible that the fungus may prove to be a slow parasite, but of course the only evidence in support of this is its constant association with the disease. However, another species of this genus, *Melanconium sacchari,* is usually accredited with being the causal agent of a destructive disease of sugar cane.[4] There is need of further work, particularly inoculation experiments, to throw light on the question.[4a]

## II. NECTRIA CANKER OF THE SWEET BIRCH (*Betula lenta* L.)

This was easily to be reckoned the most destructive disease of the sweet birch in the New York area, and is causing a great deal of damage. The writer has had the trouble under observation since 1909, having first observed it in a forest at Orange, Conn.

[2] Collected by Ellis at Newfield, N. J., on *Juglans regia,* 1892. The writer has made an effort to find the fungus on *Juglans nigra* L., but without success.

[3] Berkeley, M. J. Notices of North American fungi. Grevillea 2: 153. 1873–4.

[4] Cook, Mel. T. The diseases of tropical plants. Pp. 81 ff. New York, 1913.

[4a] Healthy twigs of butternut, brought into the greenhouse in March, 1919, and inoculated from a pure culture of the fungus, had, on April 26, as this paper is going to press, developed 33 infections out of 59 inoculations. 19 of these 33 showed spore pustules of *Melanconium oblongum.* Checks remained uninfected. A similar series on black walnut gave negative results.

In the New York region, no tract where *Betula lenta* formed a fair per cent. of the stand was free from the disease. In the fall of 1918 a forest at Milford, Conn., was visited, where about 50 per cent. of the stand was sweet birch, and at least 90 per cent. of the trees were affected. Dr. G. P. Clinton states that he has noticed the trouble for many years, and showed the writer specimens collected on *Betula lenta* near New Haven in 1906. The writer collected specimens of the causal fungus, *Creonectria coccinea* (Pers.) Seaver (*Nectria coccinea* Fr.) from trees in Van Cortlandt Park, Mt. St. Vincent, Staten Island, and the terminal moraine north of Hollis, L. I., but the disease was seen in many other localities.

The symptoms are typical lipped cankers, which if old are open, but in a younger stage may be still covered over with dead bark and then only appear as sunken spots with the bark cracked at the margins. Usually several cankers appear on a single tree, distributed at irregular intervals along the trunk and branches. Branches even as small as ½ inch in diameter may have the cankers, and such lesions, from their characteristic, irregular, nodular appearance, may be recognized readily from a distance. The fungus advances in the living bark during the season of inactivity of the host. Thus, during October, November and early December, and again in early spring, the new bark recently killed by the fungus can easily be observed by cutting in at the margins of the canker. The freshly diseased cortex has a sodden consistency and a dark reddish hue, contrasting sharply with the yellow color of the healthy inner bark, while at the boundary between the two a dark red line appears. With the new season's growth of the cambium, the inroads of the fungus are temporarily checked, to be resumed again in the fall. In this way the successively receding layers of wood about the canker are formed. The disease thus progresses slowly, and in many cases may be present in the tree for a long period, the increase in circumference of the tree more or less compensating for the loss of cortex through the fungous attack. One large tree, about 2½ feet in diameter, breast high, near Whitestone, L. I., was seen which had been affected apparently for many years, one of the cankers, near the

base of the trunk, being about 1½ feet in diameter. Often, however, trees are eventually killed out, especially if due to suppression their diameter growth is slow.

The fruiting bodies, or perithecia, begin to ripen in August; and although some were found to contain mature spores by the end of the month, in most cases the spores are not ripe until the latter part of September or in October. During the winter it is possible to obtain ripe fruiting bodies on almost any canker. Sometimes these are few and very inconspicuous, being scattered about singly or in twos or threes in crevices in the bark; but occasionally their aggregation in groups makes them readily visible. But even where very few, they can be easily detected with the naked eye (being a little less than .5 mm. in diameter) appearing as small, bright crimson dots, located on the diseased bark, not far from the border line of healthy and diseased tissue. In shape the perithecia are ovoid: 19 specimens taken from different sources measured $406 \times 288\,\mu$.

The ascospores are colorless, two-celled, and when ripe, often show pronounced constriction at the septum. The majority of the specimens examined were very blunt or rounded at the ends when mature, although many were fusoid, and in the younger stages they were always fairly sharp pointed. Measurements of 75 spores from various sources, averaged $14.5 \times 7.5\,\mu$. These figures agree with those given in the North American Flora,[5] except that our spores are a little wider. But Dr. Seaver, to whom specimens were submitted, says that there is no doubt that it is *Creonectria coccinea* (Pers.) Seaver.

Macroconidia developing from pure cultures on oat agar were yellow in mass, transparent when viewed under the microscope, averaging about $70 \times 6\,\mu$, blunt at the ends and with 5 to 8 septa —usually 7. They are slightly curved, and usually a trifle thicker toward one end (Plate 10, fiig. 4, *a*).

Of exsiccati, N. A. F. 161, *Nectria coccinea* Fr. collected at Newfield, N. J., on bark of dead *Magnolia,* showed spores averaging about $16 \times 5\,\mu$, without constrictions. Fungi Col. 2043, *Nectria coccinea* Fr., on *Tilia americana,* London, Canada, showed

[5] Seaver, F. J. Hypocreales, in North American Flora $3^1$: 21. 1910.

spores about $14 \times 5\,\mu$ and also without constrictions. These are nearer the figures given in the North American Flora.

Although this fungus, under the name of *Nectria ditissima* Tul., is presumably the cause of the "European apple-tree canker" in North America,[6, 7, 8] we have found no reference to it as a pathogenic organism on forest trees in North America, if we except the paper by Pollock,[9] in which he speaks of a fungus resembling *N. coccinea,* associated with a canker of the yellow birch (*Betula lutea* Michx. f.) in Michigan. Many points in his description coincide with the facts set forth above. In particular, his spores agree with ours in that they are wider than the figures cited in the type descriptions. Perhaps the variation in form is due to the influence of the host. Cook[10] has reported a *Nectria* parasitic on the Norway maple, but was unable to determine the species with certainty. In correspondence with the writer he has stated that it was probably *Nectria cinnabarina.*

As already intimated, *Nectria ditissima* Tul. as well as *N. coccinea* Fr. are considered synonyms of *Creonectria coccinea* (Pers.) by Seaver in the treatment in North American Flora. Yet there still seems to be some confusion as to just what is meant by *Nectria ditissima* Tul. Seaver[11] says: "So far as we can see the species (*Creonectria coccinea*) scarcely differs from *Nectria ditissima* Tul. If the two species are distinct, the characters are so poorly understood that they have been badly confused." We have for a long time been accustomed to regarding *Nectria ditissima* Tul. as the causal fungus of the canker of deciduous trees in Europe. And yet, according to Shear,[12] Euro-

6 Wilson, G. W. Notes on three limb diseases of apple. N. C. Agr. Expt. Sta. Rept. **35**: 49. 1913.

7 Duggar, B. M. Fungous diseases of plants. Pp. 242–243. 1909.

8 Morse, W. J. Spraying experiments and apple diseases in 1913. Me. Agr. Expt. Sta. Bul. **223**: pp. 23–24. 1913.

9 Pollock, J. B. A canker of the yellow birch and a Nectria associated with it. Mich. Acad. of Sci. Rept. **7**: 55–56. 1905.

10 Cook, Mel. T. A Nectria parasitic on the Norway maple. Phytopath. **7**: 313–314. 1917.

11 Seaver, F. J. The Hypocreales on North America. Mycologia **1**: 188–189. 1909.

12 Shear, C. L. Some observations on phytopathological problems in Europe and America. Phytopath. **3**: 80 ff. 1913.

pean mycologists have recently stated that the fungus causing the apple canker in Europe has been incorrectly identified and is not *Nectria ditissima* Tul. but *Nectria galligena* Bres., a fungus which has not been reported from this country. It seems probable, therefore, that the true European Nectria canker does not occur here." No exsiccati of *N. galligena* Bres. have been available for examination, but the description by Wollenweber[13] agrees with our form in all points, especially as regards ascospores and macroconidia.

Without entering into further discussion, it would seem to the writer very desirable that a comparative study involving both cultural and infection methods be carried on for *Creonectria coccinea* and *Nectria galligena* to determine whether they are really distinct.

## III. WINTER INJURY OR LEAF SCORCH OF THE BEECH (*Fagus atropunicea* (Marsh.) Sudw.)

Diseased or dying beeches were observed all over the region explored, particularly in Van Cortlandt Park, the Palisades of the Hudson and Staten Island. The most striking symptom was a reddish-brown coloration of the tips and margins of the leaves, and this often extended in irregular patches between the parallel veinlets characteristic of this leaf down to the midrib. In many cases the bark of the trunk and branches was quite sound; in others, whole branches were entirely dead, especially toward the top of the tree. No fungus was apparent on the leaves, nor was any pathogenic form discovered on the dead bark. All the evidence, therefore, pointed to a root trouble. If we take into consideration the very severe winter of 1917–18, there is no doubt that the extreme conditions occurring then killed out a portion, at least, of the roots. Whether these trees will recover or not depends on the relative amount of damage to the root system. All the dead branches should be pruned off and the living ones also cut back heavily in order that the tree may regain the balance

[13] Wollenweber, H. W. Ramularia, Mycosphaerella, Nectria, Calonectria. Eine morphologisch pathologische Studie zur Abgrenzung von Pilzgruppen mit cylindrischen und sichelförmigen konidienformen. Phytopath. 3: 197–242, *pl. 1–3*. 1913. See also another paper by the same author: Studies on the Fusarium problem. Phytopath. 3: 24–51. 1913.

between root and shoot system, and, in the balance account, perhaps have a little credit left on the side of the root system.

## IV. HEART ROT OF OAK (*Quercus* spp.)

Three fungi of interest were observed causing heart rot of different species of oak, as follows:

1. *Globifomes graveolens* (Schw.) Murr.—In a forest of oak, sweet birch and red maple, near Mt. Loretto, Staten Island, a red oak (*Quercus rubra* L.), 16 inches in diameter, breast high, had recently been broken about 12 feet from the base and blown over, the freshness of the damage being attested by the wilted, green leaves. Scattered along the surface of the bark from the base of the tree to the breaking point at fairly regular intervals were four fine specimens of this fungus, an organism which is of rare occurrence in North America, and never before found in this locality. From a little distance it resembles a small beehive with one side more or less flattened and cemented firmly to the bark. On closer inspection it may be seen to consist of a large number of small, tightly overlapping, light to very dark gray sporophores of polyporaceous nature, all proceeding from a common center or core (Plate 10, fig. 3).

There is good evidence that the fungus is a facultative parasite, for where the wood was exposed by the break it was covered with a thin sheet of white mycelium which was connected with the sporophores. Investigation showed the heartwood to be infested everywhere with the mycelium, which, in spots, was encroaching on the sapwood also. The fruiting bodies were borne in furrows of the bark, perhaps in regions of old branches. The fungus had apparently gained entrance through a fire scar which extended 18 feet up the trunk.

That the fungus is also saprophytic is shown by collections in the herbarium of the New York Botanical Garden from dead hickory in Indiana, and from a dead stump in Delaware. Other collections at the Garden are from North and South Carolina; from Pennsylvania, Ohio and Iowa. It has been collected on living *Quercus coccinea* at Wilmington, Delaware, by Dail. The specific name was derived from its sweet odor, which, however, was not evident in our specimens.

2. *Inonotus hirsutus* (Scop.) Murr.—The rusty brown or chestnut colored, hairy surface of the pileus of this species, also commonly known as *Polyporus hispidus* Fr., distinguishes it from the nearly related species with a glabrous pileus, *I. dryophilus* (Berk.) Murr., which is the agent of a very destructive heart rot of oaks in the United States.[14] With age the rusty brown color may take on a black, carbonaceous hue, but usually some portion of the pileus still has a ferruginous cast. Moreover, old specimens often lose their dense covering of matted hairs, but are still quite roughened.

A tree of black oak (*Quercus velutina* Lam.) in a forest on Staten Island was found badly diseased, evidently through the action of this fungus. Commencing about 10 feet from the base of the tree were several elongated cankers extending upward for about 8 feet on the trunk and bearing fruiting bodies of the fungus on exposed diseased wood. The trunk was considerably hypertrophied in the region of the cankers, which were fairly close together, and thus a long, spindle-shaped swelling in the bole was formed—a condition which indicated the destruction of the inner wood by the fungus, and an attempted compensation for this by increased growth of the sapwood.

Dr. Murrill says that the species is rare in this country, but common and virulent in Europe and very destructive to shade trees there. The writer collected it on living European ash (*Fraxinus excelsior* L.) near Torquay, Devon, England, in 1915, and also observed it on the same host in 1914 near Rugby, Warwick. According to Prillieux[15] the parasite is not uncommon on mulberry trunks in France. The same investigator and Delacroix record it among the enemies of the English walnut (*Juglans regia* L.) in France.[16] Butler[17] states that it is destructive to

[14] Hedgcock, G. G. Notes on some diseases of trees in our national forests. II. Phytopath. 2: 73, 74. 1912.

[15] Prillieux, E. Maladies des plantes agricoles 1: 352. 1895.

[16] Prillieux, E., and Delacroix, G. Les maladies des noyers en France, Bul. de l'agricult. 1898: 1–14. Ref. in Just's Bot. Jahresb. $26^1$: 177. 1898.

[17] Butler, E. J. Mulberry diseases. Mem. Dept. Agr. India. Bot. Ser. $2^8$: 1–18.

The writer has been able to find no reference to this fungus as a pathogen in the United States.

apples, plums, apricots and especially mulberries in Kashmir, India. It is found in the trunk, but also attacks the larger branches. Butler finds that the fungus enters branch scars where heart-wood is exposed, and says: "The tissues are little by little destroyed from within out, becoming soft, spongy and yellowish white. The trunk may be almost completely hollowed, but often a ring of still living wood is left which is sufficient to keep the crown green." In most cases the trees thus weakened are blown over before they are killed out entirely. This mode of action corresponds closely with the condition of affairs in the oak above described.

3. *Pyropolyporus Everhartii* (Ellis & Gall.) Murr.—A huge pin oak (*Quercus palustris* Muench.) at Englewood Heights, N. J., has attracted a good deal of attention for a number of years on account of numerous gnarly swellings which appear toward the base of the trunk. Each swelling was found to contain in some part of it young or old fruiting bodies of this fungus—also known as *Fomes Everhartii* (Ellis and Gall.) von Schrenk and Spauld.—indicating that the organism was the cause of the disturbance (Plate 10, fig. 1). The fungus had grown in the trunk for a long period of years, if one were to judge from the thickness of the bark and wood of which the swellings were composed.

That this species has parasitic habits has already been pointed out by Von Schrenk and Spaulding,[18] who found it of common occurrence on living black jack oak (*Quercus marilandica* Muench.) and determined that the mycelium of the fungus "was capable of growing into the sapwood of the living tree." Hedgcock[19] finds it causing a very destructive heart rot in a large number of species of oak in the United States and states that it is the cause of the most common and destructive heart rot of walnut, especially *Juglans rupestris,* although *J. nigra* and *J. californica* are frequently attacked. *J. cinerea* is apparently rarely attacked. Other hosts are *Prosopis juliflora* (Swartz) deC. the mesquite, *Fagus atropunicea* (Marsh.) Sudw. the beech, *Betula papyrifera*

[18] Von Schrenk, H., and Spaulding, P. Diseases of deciduous forest trees. U. S. Dept. Agr. Bur. Plant Ind. Bul. 149, p. 48. 1909.

[19] Hedgcock, G. G. L. c. pp. 74, 75.

Marsh, the paper birch, and other species of birch. Weir[20] records it on living trunks of *Populus trichocarpa* Torr. & Gr., the black cottonwood, in Montana.

The sporophores resemble closely those of *Pyropolyporus* (*Fomes*) *igniarius* (L.) Murr., but the spores of the latter are colorless, while those of this species are yellowish brown. Another distinctive feature seems to be the bright yellow color of the mycelium of which the pileus is composed. Dr. Murrill says that he also has used this bright color as a field character.

## V. DISEASE OF THE WHITE OAK (*Quercus alba* L.)

All over Staten Island the white oaks of large size were found to be dying out. This was not due to the severe winter preceding, for Dr. Arthur Hollick, of the Staten Island Institute of Arts and Sciences, informed the writer that the trouble has been going on for several years. There was no patch of forest in which the dying and dead trees could not be seen on every hand. Rhizomorphs (possibly of *Armillaria mellea* (Vahl.) Quélet) were found under the bark of many, but not all trees. It seemed as if the larger trees were the ones that were affected. In some instances traces of a boring beetle were seen.

## VI. BARK DISEASE OF THE PAPER MULBERRY (*Broussonetia papyrifera* Vent.)

Near Bayside, L. I., a large paper mulberry about one foot in diameter breast high, growing as a shade tree in a front yard, was found badly diseased by *Creonectria purpurea* (L.) Seaver (*Nectria cinnabarina* Fr.) at the base of the trunk. The potential pathogenicity of this species has been proven beyond question,[21] and there was no doubt here that the fungus was advancing in the living bark. And yet it is known to often lead a purely saprophytic life on dead twigs.

[20] Weir, J. R. Montana forest tree fungi I. Polyporaceae. Mycologia **9**: 135. 1917.

[21] Mayr, H. Über den Parasitismus von Nectria cinnabarina. Untersuch. a. d. Forstb. Inst. zu München. III. 1882

### VII. BLIGHT OF SYCAMORE (*Platanus occidentalis* L.)

The blight of sycamore, caused by *Gnomonia veneta* (Sacc. & Speg.) Kleb. was seen in many places: practically no sycamore was free from it. The fungus appears to be a slow parasite, growing more especially during the early spring months during the period of dormancy of the host. When observed during the summer, the fungus had in all cases apparently ceased its growth, after killing terminal twigs here and there. This habit is probably largely responsible for the scraggly appearance of our sycamore trees.

### VIII. HEART ROT OF LOCUST (*Robinia pseudacacia* L.)

The black locust is very common in the area under consideration, especially on Long Island. Its worst fungous enemy is *Pyropolyporus Robiniae* Murrill, which attacks the heart-wood.[22] The fruiting bodies are large, hoof-shaped structures, and are of common occurrence but do not attract attention because they are dark colored and usually high up on the trunk.

During the summer the depredations caused by the locust leaf miner (*Chalepis dorsalis* Thunb.) were conspicuous.

### IX. INJURY FROM THE WINTER CONDITIONS OF 1917–18

In an account of the most important and interesting pathological features of the trees in the New York region, the effects of the severe winter of 1917–18 should by no means be omitted. It is entirely unnecessary for the writer to establish the fact that the winter was unprecedented, for that was perfectly clear to all at the time. What he would like to emphasize is that the combination or the chain of meteorological phenomena, aside from the mere fact of the extreme cold itself, was especially unfavorable for plant life. This cannot be better set forth than by quoting from Dr. Taylor.[23] After remarking on the extremely low temperatures toward the latter part of December, he con-

[22] Schrenk, H. von. A disease of the black locust. Mo. Bot. Gard. Rept. 12: 21–31. 1901.

[23] Taylor, N. Effects of the severe winter on the woody plants in the garden. Brooklyn Botanic Gard. Record 7: 83–87. 1918.

tinues as follows: "The first four days of the year showed minimum temperatures of —5°, +2°, 0°, and —3° respectively, and on January 12 the temperature was 50°. Worst of all, on the latter day, the velocity of the wind was greater here than in any other place in the country, the record showing maximum velocity of 84 miles an hour, from the southeast. The following of such extreme cold by a warm wind of this great velocity apparently played havoc with many valuable plants in the Garden. With the ground frozen to depths unknown before, as there was practically no snow covering during the coldest days, the root activity of most plants would be stopped, while the warm wind on the twelfth, when the maximum temperature for January was recorded, would dry out many evergreens, even if they had withstood the cold of a few days before. Because of this combination of cold temperatures followed by warm wind, it is perhaps impossible to ascribe all our losses to cold alone. Certainly one or the other, or most probably their combination, has had disastrous results. . . ."

Taylor found that in the Brooklyn Botanic Garden 28 kinds of plants were killed outright, 20 killed to the ground, 70 severely winter-killed, and 28 slightly winter-killed.

In Central Park, the writer saw hundreds of trees which had suffered severely from these conditions, some killed outright, and most of them damaged beyond possible recovery. Prominent among the victims were large numbers of handsome beeches, sycamore maples, silver, red and Norway maples, cut-leaved birches, white mulberry, sassafras, black cherry, American elm, basswood, Turkey and pin oaks, and many others. Along the walk south of the reservoir, which was exposed to the full force of a north wind across the water, nearly every tree was dead or dying. Horsechestnuts and oriental planes seemed to stand the test as well as any species.

The following points should dispel any doubt that the winter was responsible for these conditions:

1. A large *variety* of species was affected.
2. The worst destruction appeared in exposed localities.
3. The symptoms were characteristic of winter injury; i. e.,

a browning of the leaves, casting of the leaves, and developing of suckers.

That the damage was so extensive in Central Park is to be accounted for partly by the character of the soil, which for the most part is hard and packed with the tramp of many feet. This condition, coupled with the absence of leaf mulch, rendered both radiation and evaporation more rapid from the surface, and therefore cold and drought penetrated much more readily and deeply than would be the case in the normal forest, where the soil is a deep rich humus covered with a blanket of decaying leaves.

Of susceptible species noted in other places, the sweet cherry, *Prunus avium* L., was the most conspicuous, and trees of this species killed outright were a very common sight. *Liquidambar* trees at Mt. St. Vincent and on Long Island were also notable sufferers. Many *Ailanthus* trees and especially the Lombardy poplar—the latter in the marginal park between the Hudson and Riverside Drive—were entirely killed. It is interesting to recall that *Liquidambar* is here near the northern limit of its range.

NEW HAVEN,
CONNECTICUT.

EXPLANATION OF PLATE

Fig. 1. Pin oak (*Quercus palustris* Muench.) at Englewood Heights, N. J., showing cankerous growths caused by *Pyropolyporus Everhartii* (Ellis & Gall.) Murr. This and the following photographs taken by Mr. Louis Buhle, Brooklyn Botanic Garden.

Fig. 2. Sweet birch (*Betula lenta* L.) with canker caused by *Creonectria coccinea* (Pers.) Seaver. On terminal moraine north of Hollis, L. I.

Fig. 3. Fruiting body of *Globifomes graveolens* (Schw.) Murr. from living red oak (*Quercus rubra* L.) in a forest near Mt. Loretto, Staten Island. One half natural size.

Fig. 4. Spores of *Creonectria coccinea* (Pers.) Seaver. *a*, macroconidia; *b*, ascospores. × about 300.